

CLAIMS

What is claimed is:

1. A method for operating an electromagnetic coil gun system, comprising the steps of
providing an electromagnetic coil gun system including
a launcher comprising
5 a barrel having a longitudinal bore therethrough, wherein the barrel has a breech end and a muzzle end, and
a plurality of longitudinally extending electrical excitation coils arranged circumferentially around the bore of the barrel so that a magnetic field produced by an electrical current in each electrical excitation coil penetrates
10 into the bore, wherein each electrical excitation coil is independently activated by the electrical current passed therethrough, and
a projectile sized to be received within the bore of the barrel, wherein the projectile comprises a circumferential armature at a tail end thereof, and a nose end;
15 loading the projectile into the bore with the tail end of the projectile adjacent to the breech end of the barrel; and
firing the projectile from the barrel by the steps of
producing a traveling sequence of propulsive currents in the electrical excitation coils moving in a direction from the breech end toward the
20 muzzle end of the barrel, whereby a traveling propulsive magnetic field produced by the electrical excitation coils interacts with the armature of the projectile to propel the projectile in the direction from the breech end toward the muzzle end of the barrel, and simultaneously
producing a traveling nulling magnetic field to at least partially
25 nullify the traveling propulsive magnetic field at the nose end of the projectile.
2. The method of claim 1, wherein the step of producing a traveling nulling magnetic field includes the step of

producing a traveling sequence of field-nulling currents in a circumferential direction opposite to the propulsive currents.

3. The method of claim 1, wherein the step of providing the electromagnetic coil gun system includes the step of providing the projectile having a guidance subsystem in the nose thereof.

4. The method of claim 1, wherein the step of providing the electromagnetic coil gun system includes the step of providing the projectile having a guidance subsystem in the nose thereof and magnetic shielding for the guidance subsystem.

5. A method for operating an electromagnetic coil gun system, comprising the steps of

providing an electromagnetic coil gun system including a launcher comprising

5 a barrel having a longitudinal bore therethrough, wherein the barrel has a breech end and a muzzle end, and

a plurality of longitudinally extending propulsive electrical excitation coils arranged circumferentially around the bore of the barrel so that a traveling propulsive magnetic field produced by a propulsive electrical current in
10 each propulsive electrical excitation coil penetrates into the bore, wherein each propulsive electrical excitation coil is independently activated by the propulsive electrical current passed therethrough,

a plurality of longitudinally extending nulling electrical excitation coils arranged circumferentially around the bore of the barrel so that
15 nulling magnetic field produced by a nulling electrical current in each nulling electrical excitation coil penetrates into the bore, wherein each nulling electrical excitation coil is independently activated by the nulling electrical current passed therethrough, and

a projectile sized to be received within the bore of the barrel,
20 wherein the projectile comprises a circumferential armature at a tail end thereof,

and a nose end;

loading the projectile into the bore with the tail end of the projectile adjacent to the breech end of the barrel; and

firing the projectile from the barrel by the steps of

25 producing a traveling sequence of propulsive currents in the propulsive electrical excitation coils moving in a direction from the breech end toward the muzzle end of the barrel, whereby a traveling propulsive magnetic field produced by the propulsive electrical excitation coils interacts with the armature of the projectile to propel the projectile in the direction from the breech
30 end toward the muzzle end of the barrel, and simultaneously

 producing a traveling sequence of field-nulling currents in the nulling electrical excitation coils moving in the direction from the breech end toward the muzzle end of the barrel but closer to the muzzle end of the barrel than the traveling sequence of propulsive currents and leading the traveling sequence
35 of propulsive currents, wherein the field-nulling currents are in a circumferential direction opposite to the propulsive currents, thereby at least partially nulling the traveling propulsive magnetic field at the nose end of the projectile.

6. The method of claim 5, wherein the step of producing a traveling sequence of field-nulling currents includes the step of

 producing the traveling sequence of field-nulling currents, wherein a maximum field-nulling current is smaller in magnitude than a maximum
5 propulsive current.

7. The method of claim 5, wherein the step of producing a traveling sequence of field-nulling currents includes the step of

 producing the traveling sequence of field-nulling currents, wherein a maximum field-nulling current is less than about 10 percent of a maximum
5 propulsive current.

8. The method of claim 5, wherein the step of producing a traveling sequence of field-nulling currents includes the step of

producing the traveling sequence of field-nulling currents, wherein a maximum field-nulling current is shorter in spatial extent than a maximum propulsive current.

9. The method of claim 5, wherein the step of providing the electromagnetic coil gun system includes the step of providing the projectile having a guidance subsystem in the nose thereof.

10. The method of claim 5, wherein the step of providing the electromagnetic coil gun system includes the step of providing the projectile having a guidance subsystem in the nose thereof and magnetic shielding for the guidance subsystem.

11. The method of claim 5, wherein the step of providing an electromagnetic coil gun system includes the step of providing the propulsive electrical excitation coils and the nulling electrical excitation coils as the same electrical excitation coils.

12. A method for operating an electromagnetic coil gun system, comprising the steps of providing an electromagnetic coil gun system including a launcher comprising

5 a barrel having a longitudinal bore therethrough, wherein the barrel has a breech end and a muzzle end, and

a plurality of longitudinally extending electrical excitation coils arranged circumferentially around the bore of the barrel so that a magnetic field produced by an electrical current in each electrical excitation coil penetrates into the bore, wherein each electrical excitation coil is independently activated by the electrical current passed therethrough, and

10 a projectile sized to be received within the bore of the barrel, wherein the projectile comprises a circumferential armature at a tail end thereof, and a nose end;

15 loading the projectile into the bore with the tail end of the projectile
adjacent to the breech end of the barrel; and
firing the projectile from the barrel by the steps of
producing a traveling sequence of propulsive currents in the
electrical excitation coils moving in a direction from the breech end toward the
20 muzzle end of the barrel, whereby a traveling propulsive magnetic field produced
by the electrical excitation coils interacts with the armature of the projectile to
propel the projectile in the direction from the breech end toward the muzzle end
of the barrel, and simultaneously
producing a traveling sequence of field-nulling currents in the
25 electrical excitation coils moving in the direction from the breech end toward the
muzzle end of the barrel but closer to the muzzle end of the barrel than the
traveling sequence of propulsive currents and leading the traveling sequence of
propulsive currents, wherein the field-nulling currents are in a circumferential
direction opposite to the propulsive currents, thereby at least partially nulling the
30 traveling propulsive magnetic field at the nose end of the projectile.

13. The method of claim 12, wherein the step of producing a traveling
sequence of field-nulling currents includes the step of
producing the traveling sequence of field-nulling currents, wherein a
maximum field-nulling current is smaller in magnitude than a maximum
5 propulsive current.

14. The method of claim 12, wherein the step of producing a traveling
sequence of field-nulling currents includes the step of
producing the traveling sequence of field-nulling currents, wherein a
maximum field-nulling current is less than about 10 percent of a maximum
5 propulsive current.

15. The method of claim 12, wherein the step of producing a traveling
sequence of field-nulling currents includes the step of
producing the traveling sequence of field-nulling currents, wherein a

5 maximum field-nulling current is shorter in spatial extent than a maximum propulsive current.

16. The method of claim 12, wherein the step of providing the electromagnetic coil gun system includes the step of providing the projectile having a guidance subsystem in the nose thereof.

17. The method of claim 12, wherein the step of providing the electromagnetic coil gun system includes the step of providing the projectile having a guidance subsystem in the nose thereof and magnetic shielding for the guidance subsystem.